PATENT SPECIFICATION

DRAWINGS ATTACHED

842,164

Date of Application and filing Complete Specification: June 17, 1957.

No. 19050/57.

Complete Specification Published: July 20, 1960.

Index at Acceptance :—Class 80(2), USA1.

International Classification :—F06d.

COMPLETE SPECIFICATION

Improvements in or Relating to Articulated Joints

We, LUCIANO CHIERICHETTI, an Italian Citizen of Corso Lodi, 113, Milan, Italy and ANGIOLINO BUCCI, an Italian Citizen of Via Pola 19, Milan, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in any by the following statement :

This invention relates to articulated joints for connecting the rotatable shafts whose axes are or may be at an inclination to one another during rotation, which inclination may be variable.

One known form of joint of this character comprises two end members, usually in the form of sleeves, which are fixable, in any conventional manner, to the shafts to be connected. These end members are provided, at the ends thereof opposite to one another in the assembled joint, with at least two diametrically opposed projections having at the free end thereof pins or the like. Arranged between the two end members is a central body formed with cavities in which said pins are engaged alternately so as to provide an articulated connection of the end members to one another.

Joints of this form tend to be unsatisfactory in that the central body, which in the use of the joint is subjected to considerable stress, is weakened by the cavities. Also the pins which engage in these cavities, inasmuch as they bear directly upon the surfaces of the cavities, tend to impose a limit upon the permissible rotational speed of the shafts connected through the joint, due to sliding friction developed at the surfaces of the pins and consequent over-heating of the joint, which over-heating may result in distortion of the relatively movable parts of the joint. A further inconvenience of the above-mentioned for of joint is that owing to the general design of the joint it is impossible to provide for effective lubrication of the movable parts of the joint which are subjected to the greatest heating, such as could at least reduce the over-heating and consequent distortion referred to.

In another known form of joint, the torque is transmitted between the two end members of the joint, which are generally in the form of sleeves, through a cruciform member incorporaing aligned pins which turn in and are supported by arms carried on the end members, and in various embodiments of this form of joint the pins of the cruciform member are supported by roller or ball bearings in such a way as to reduce friction between the relatively moving parts of the joint, thereby raising the maximum permissible rotational speed of the shafts which are connected through the joint. Also in joints of this form continuous lubrication of the moving parts is possible.

Even if in joints of this latter form certain of the inconveniences mentioned above of the joints having a cavitied central body and not provided with rolling bearings still exist, the embodiments so far known of such joints tend to be cumbersome, for which reason they are not suited for those applications which require that the joint shall occupy a minimum amount of space while being capable of transmitting torques of high magnitude. Thus the arms wherein the pins of the cruciform member are supported, which arms are generally affixed to the outside of the sleeves or may be formed integrally therewith, have in radial sense large dimensions with respect to the diameter of the shafts to be connected. In consequence, the cruciform member takes up excessive space and it is impossible to bring and concentrate all the parts of the joint near to the centre of rotation.

The present invention has for its object to provide an articulated joint of the latter form mentioned with overall dimensions which are reduced to a minimum consistent with the capacity of the joint to transmit a high measure of torque, the joint possessing,

[Price 3s. 6d.]

however, good characteristics from the point of view of low heat generation and capability of being run, even continuously, at a high rotational velocity, of the transmission.

For purposes of definition, the improved joint of the present invention may be said to be of the type comprising two body portions adapted to be fixed respectively to the shafts to be connected through the joint, and a trunnion member located centrally between said body portions, said trunnion member carrying two pairs of coaxial pins whose common axes intersect one another at right angles at the point of intersection of the shaft axes, said pin pairs forming respectively. a pair of trunnions upon which respectively the body members are pivotally mounted through the intermediary of roller bearings intervening between the pins and bearing carriers projecting axially of the joint from the end faces in mutually opposed relation to one another of the end members, there being two pairs of bearing carriers corresponding respectively to the two pairs of trunnion pins and the trunnion pins and bearing carriers of each pair thereof being located at respectively opposite sides of the rotational axis of the joint.

According to the present invention, an articulated joint of this type for connecting two rotatable shafts whose axes are or may be at an inclination to one another during rotation, is provided wherein the bearing carriers are of part-spherical shape and wherein there are provided in each of the end faces in mutually opposed relation to one another of the end members, at locations situated, in the case of each end face, between the two bearing carriers projecting therefrom, a pair of part-spherical cavities which receive the crowns of the bearing carriers projecting from the opposite end face as the shafts rotate with their axes at an inclination to one another.

By the particular configuration and arrangement of the elements in which the trunnion member is supported, the invention provides a compact construction requiring little space and at the same time it has made it possible to use a roller bearing notwithstanding the relatively small radial dimensions of the joint.

The essential characteristic that has permitted this result consists in the part-spherical shape of the bearing carriers and of the recesses which receive these carriers in the end faces of the end members. The joint of this invention is therefore particularly suited for the coupling of shafts having small radial dimensions, but which have to transmit large torques at high speed.

To make the invention more fully clear, reference will now be made to one preferred embodiment thereof illustrated diagrammatically and by way of example in the accompanying drawings.

In these drawings :

Figure 1 represents the articulated joint of the invention in perspective view with some of the parts of the joint broken away and shown in section ;

Figure 2 is an elevational view of the same articulated joint, drawn partly in section ; and

Figure 3 is a cross-section through the joint on the horizontal plane A–A of Figure 2.

With reference to the drawings, 1 and 1^1 indicate the two end members of the joint, which can be fixed in any known manner to the two shafts to be connected. These shafts are not shown in the drawings.

On each of the end faces in mutually opposed relation to one another in the assembled joint, of the end members 1 and 1^1, there are provided a pair of projections 2 or 2^1. These projections, which constitute the " bearing carriers " hereinbefore referred to, are located, in the case of each pair, on a diametral line through the centre of the relative end face and the two diametral lines are at 90° to one another in the manner clearly shown in Figure 3. The projections of each pair thereof 2 or 2^1 are formed separately from the end members and each has a spigot portion which is let into a recess in the end face of the relative end member and firmly secured in position by pinning.

The projections 2 and 2^1 are, as shown, of part-spherical shape and each projection is formed with an internal cavity 3 or 3^1 of mainly cylindrical form whose axis is radial to the joint and whose mouth end is directed towards the centre of the joint.

Located centrally of the joint, between the four projections 2 and 2^1 is a massive member 4 constituting the " trunnion member " hereinbefore referred to

The member 4 carries four pins 4^1 disposed with their respective axes at right angles to one another and coincident respectively with the axes of the cavities 3 or 3^1. The pins 4^1, which constitute the " trunnion " hereinbefore referred to, are pivotally supported by the projections 2 or 2^1 through the intermediary of roller bearings 5 or 5^1 arranged between the peripheries of the pins and the peripheral wall surfaces of the cavities 3 or 3^1 in the manner clearly shown in the drawings. In this way the two end members 1 and 1^1 of the joint are connected together with freedom for universal movement as the shafts to which the end members are respectively connected rotate.

In the end faces aforesaid of the end members 1 and 1^1 are cavities 6 and 6^1 of part-spherical shape in which the adjacent end portions of the projections 2 and 2^1 are received with clearance as the joint rotates

with the shafts at an inclination to one another. There are two cavities 6 and 6^1 in each end member, situated midway between the two projections 2, 2 or 2^1, 2^1 in the manner shown.

The cavities 3 and 3^1 are extended axially of the cavity so as to include in each case an end portion of the cavity of substantially conical form, said end portion forming a chamber for the reception of a lubricant introduced into the chamber by way of a small hole 7 or 7^1 at the centre of the end wall of the cavity which is normally closed by a ball 8 or 8^1 maintained in the closing position by a loading spring 9 or 9^1 interposed in compression between the back of the ball and the end face of the trunnion pin 4 or 4^1. In this way provision is made for lubrication of the roller bearings in the cavities in which the trunnion pins work.

The improved construction according to the present invention affords the following advantages, among others, with respect to the known constructions :—

Firstly, the projections 2 and 2^1, owing to their part-spherical shape, are locatable relatively near to the centre of rotation of the joint, with the result that the over-all dimensions of the joint, radially thereof, can be much less than in the known constructions.

Secondly, the central member of the joint, namely the trunnion member, is compact and its dimensions may be kept relatively small. Also this member can readily be formed in one single piece, possession great mechanical strength.

Thirdly, the part-spherical shape of the projections 2 and 2^1 enables the pins 4 and 4^1 to be supported upon the projections through the intermediary of roller bearings notwithstanding the small radial dimensions of the joint. In consequence the joint is capable of transmitting larger torques at relatively high shaft speeds even with a considerable angle of inclination of the shafts. In this connection, it may be remarked that it is known that if the joint has to transmit the movement of the shafts with the latter at an angle of from 0° to 30°, the central member has to perform, for every revolution of the driving shaft, an angular displacement varying from 0° to 60°.

Finally, contrary to those known constructions which do not permit of continuous lubrication of the relatively moving parts of the joint, the improved construction according to the present invention provides for systematic lubrication of all of the relatively moving parts without having for this purpose to increase the over-all dimensions of the joint and therefore the space it occupies when in use.

WHAT WE CLAIM IS :—

1. An articulated joint of the type described for connecting two rotatable shafts whose axes are or may be at an inclination to one another during rotation, wherein the bearing carriers are of part-spherical shape and wherein there are provided in each of the end faces in mutually opposed relation to one another of the end members, at locations situated, in the case of each end face, between the two bearing carriers projecting therefrom, a pair of part-spherical cavities which receive the crowns of the bearing carriers projecting from the opposite end face as the shafts rotate with their axes at an inclination to one another.

2. An articulated joint according to Claim 1, wherein the bearing carriers are formed separately from the end members and are individually mounted thereon.

3. An articulated joint according to Claim 2, wherein the bearing carriers are formed with spigot portions which are received in recesses in the end face of the relative end member and are locked therein by pinning.

4. An articulated joint according to any of the preceding Claims, wherein the trunnion pins and their respective roller bearings occupy cavities provided for their reception in the bearing carriers, said cavities being of circular cross-section and coaxial with the pins and their inner peripheries forming bearing surfaces for the rollers of the roller bearings.

5. An articulated joint according to Claim 4, wherein said cavities in the bearing carriers include in each case an end portion thereof which is located beyond the outer end of the relative trunnion pin and forms a chamber for the reception of a lubricant for the roller bearing, said end portion being bounded by an end wall of the cavity disposed opposite the end face of the outer end of the relative trunnion pin and having in it a hole for the introduction of the lubricant into the chamber, which hole is normally closed by a ball spring loaded into the closing position by a spring interposed between the ball and said end face of the trunnion pin.

6. An articulated joint constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

G. F. REDFERN & CO.,
Redfern House, Dominion Street,
London, E.C.2.
Agents for the Applicants.

London : Printed for Her Majesty's Stationery Office, by E. G. Ellis & Sons.—1960
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

842164
1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale

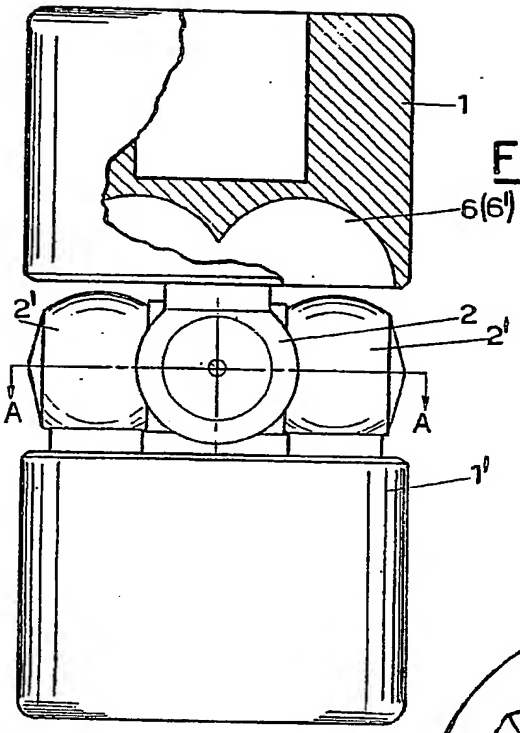

Fig.2

Fig.1

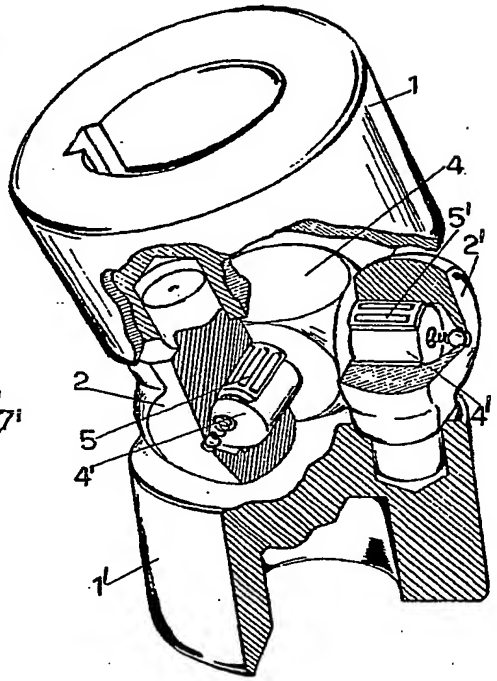

Fig.3